CLAIMS

I claim:

1. A method of calibrating a digital image capture device, comprising the steps of:

acquiring a test target;

determining measurement values from the test target;

normalizing the measurement values to a range of 0 to 1;

determining white point chromaticity for the digital image capture device;

converting the normalized measurement values to the digital image capture device white point chromaticity;

capturing raw color values of the test target with the digital image capture device;

normalizing the captured raw color values to a range of 0 to 1;

regressing the normalized measurement values with the normalized raw color values to determine a first compensation matrix; and

verifying a level of color fidelity of the digital image capture device.

2. The method of claim 1, wherein the step of determining measurement values from the test target comprises the step of accepting published measurement values for the test target in a physical color space.

3. The method of claim 1, wherein the step of determining measurement values from the test target comprises the step of measuring the test target with calibrated test equipment in a physical color space.

4. The method of claim 1, wherein the step of converting the normalized measurement values to the digital image capture device white point chromaticity comprises the step of using simplified Bradford white point adaptation equations to bring the normalized measurement values into the capture device color space.

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5. The method of claim 1, wherein the step of capturing raw color values of the test target with the digital image capture device comprises the step of disabling any gamma correction function of the capture device prior to capturing raw color values of the test target.

6. The method of claim 1, wherein the step of regressing the normalized measurement values with the normalized raw color values to determine a first compensation matrix comprises the steps of assigning the normalized measurement values from the test target converted to the capture device white point as the dependent data, and assigning the normalized raw color data as the independent data.

7. The method of claim 6, further comprising the step of forcing a y-intercept of the regression to zero.

8. The method of claim 6, wherein the step of regressing is performed on an electronic spreadsheet.

9. The method of claim 1, wherein the step of verifying a level of color fidelity of the digital image capture device comprises the steps of:

matrix multiplying the first compensation matrix with the normalized raw color data to obtain predicted measurement values;

comparing the normalized test target measurement values converted to the capture device white point with the predicted measurement values to obtain the CIE 1996 color difference values, including ΔE^*CIE94; and

checking ΔE^*CIE94 against a predetermined threshold for acceptable color fidelity.

10. The method of claim 9, wherein the step of comparing the normalized test target measurement values converted to the capture device white point with the predicted measurement values comprises the step of converting the normalized test target measurement values converted to the capture device white point and the predicted measurement values to the $CIEL^*a^*b^*$ color space.

11. The method of claim 9, wherein the step of checking ΔE^*CIE94 against a predetermined threshold for acceptable color fidelity reveals that ΔE^*CIE94 is larger than the predetermined threshold, further comprising the step of logging an error.

12. The method of claim 9, wherein the step of checking ΔE^*CIE94 against a predetermined threshold for acceptable color fidelity reveals that ΔE^*CIE94 is equal to or smaller than the predetermined threshold, further comprising the steps of:

calculating a second compensation matrix for compensating raw color data from the capture device; and

downloading the second compensation matrix into the capture device.

13. The method of claim 12, wherein the step of calculating a second compensation matrix comprises the step of translating the first compensation matrix from capture device color space to a device independent color space.

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14. The method of claim 1, wherein the step of acquiring a test target comprises the step of developing a customized test target for a particular application.

15. The method of claim 1, wherein the step of acquiring a test target comprises the step of acquiring a test target with at least six color patches thereon.

16. The method of claim 15, wherein said at least six color patches include a white patch, a black patch, a gray patch, and three orthogonal colors.

17. The method of claim 16, wherein the gray patch is in the range of 25% to 75% gray.

18. The method of claim 1, wherein the step of acquiring a test target comprises the step of acquiring a test target whose spectral makeup is representative of the type of material of the objects whose digital images will be captured.

19. A method of achieving high color fidelity in a digital image capture device, comprising the steps of:

capturing color data from an image;

normalizing the color data to both black and white; and

compensating the normalized color data with a compensation matrix.

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20. The method of claim 19, further comprising the step of converting the compensated normalized color data from a color space of the capture device to a device independent color space.

21. The method of claim 19, wherein the step of compensating the normalized color data with a compensation matrix comprises the step of calibrating the capture device through the following steps:

acquiring a test target;

determining measurement values from the test target;

normalizing the measurement values to both black and white;

determining white point chromaticity for the digital image capture device;

converting the normalized measurement values to the digital image capture device color space;

capturing raw color values of the test target with the capture device;

normalizing the captured raw color values to both black and white; and

regressing the normalized measurement values with the normalized raw color values to determine the compensation matrix in the color space of the capture device.

22. The method of claim 21, further comprising the step of verifying a level of color fidelity of the digital image capture device by calculating color difference parameters between the normalized measurement values converted to the capture device color space and the normalized raw color data compensated by the compensation matrix in the capture device color space.

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23. A digital image capture device, comprising a memory storage element having stored therein a compensation matrix calculated as a regression of normalized raw color data from a test target and normalized measurement data from the test target converted to the color space of the capture device.

24. The digital image capture device of claim 23, further comprising processing means for normalizing captured color data of an image to black and white, said processing means further compensating the normalized captured color data with the compensation matrix to achieve high color fidelity.

25. The digital image capture device of claim 24, wherein said processing means further converts the compensated normalized color data from a color space of the capture device to a device independent color space.